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[54] Title: **SWEETENING COMPOSITION AND ITS USES**

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Description

[0001] The present invention relates to a new sweetening composition.

[0002] It also relates to the use of this sweetening composition for the manufacture of hard candies, particularly unwrapped hard candies, ie, those sold without individual wrappers and those used as flavor carriers.

[0003] Hard candies are solid, essentially amorphous confectionery products. They are obtained by forced dehydration of carbohydrate syrups. Generally, mixtures of powdered sucrose and concentrated syrups of starch hydrolyzates in proportions ranging from ca 40/60 to ca 65/35 by commercial weight are cooked. These mixtures generally contain water in a sufficient quantity to dissolve all of the sucrose crystals. These mixtures are then cooked at temperatures up to 130-150• C under ambient pressure to evaporate most of the water, and cooking is then terminated under vacuum to further reduce their water content to a level generally less than 3%. Subsequently, the plastic mass thus obtained is cooled to a temperature in the range of 125-140• C in the case of a casting process or to a temperature in the range of 90-115• C in the case of a roll-forming or extrusion process. In this stage, different substance such as flavorings, colorants, acids, plant extracts, vitamins, and pharmaceutical drugs are then added. After the cooked mass is formed or cast and after it has returned to ambient temperature, hard candies having a texture and appearance similar to glass are obtained.

[0004] The bulk of the hard candy market still consists of "sugar-containing" products prepared from non-hydrogenated carbohydrate syrups. There are also essentially amorphous hard candies known as "sugarless" or sweetened with polyols; they are obtained by a method identical to that described above but using hydrogenated carbohydrate syrups and cooking at a higher temperature to further dehydrate the boiled mass. These carbohydrate syrups are generally maltitol or hydrogenated isomaltulose syrups in solution.

[0005] The hard candies must be stable over time; that is, they must change as little as possible from the time they are manufactured to the time they are consumed so as to remain attractive products with a pleasant taste and mouthfeel.

[0006] Unfortunately, hard candies are not stable products from a thermodynamic standpoint. The extent of their change depends essentially on their composition after manufacture but also on the conditions under which they are stored.

[0007] In the first place, hard candies can become sticky during storage. When they are individually wrapped, it becomes difficult, or impossible, to eliminate their wrapping papers before consuming them. They can also increase in mass without remaining separated, which is even more annoying.

[0008] This problematic change to a sticky, syrupy state can be explained by surface phenomena and/or deep phenomena.

[0009] Surface phenomena are due to the hygroscopic character of hard candies. Indeed, hard candies, which are nearly anhydrous in nature, are invariably known to have very low equilibrium relative humidities, ie, appreciably lower than the usual ambient relative humidities at which they are stored. This explains why water is necessarily adsorbed on the surface of the candies as soon as they are exposed to air, as in the case of lollipops, for example. When this water uptake is sufficiently extensive, it tends to liquefy the surfaces of the candies and confer to them the characteristics of a syrup, ie, a sticky character. The lower the water content of the hard candies, the more rapid this change occurs.

[0010] The deep phenomena, which affect not only the surface but the entire bulk of the candies, have a thermal origin. More specifically, in order for these phenomena to occur, the storage temperature must somewhat exceed the glass transition temperature of the hard candy. This notion, referred to herein, is described in detail in the excellent article "La transition vitreuse: incidences en technologie alimentaire" by M. Le Mestre and D. Simatos, published in I.A.A., January/February, 1990. The glass transition temperature is the temperature at which a solid glassy hard candy becomes an amorphous syrupy liquid

when heated. It is readily understandable that a hard candy can undergo deformation, or completely melt down, when its storage temperature is elevated and its glass transition temperature is rather low. The product, initially dry to the touch, becomes sticky. Note that the more water the hard candy contains, the greater its risk of changing in this way during storage.

[0011] In conclusion, to prevent hard candies from becoming sticky during storage, it has always appeared necessary to make sure their water content was neither too high nor too low.

[0012] In the second place, hard candies may have a tendency to crystallize uncontrollably during storage, thereby losing their very attractive glassy appearance and looking more like barley sugars, which are known to be very different from the confectionery products targeted by the present invention. This crystallization may occur either solely on the surface of the candy or in the bulk as well.

[0013] Surface crystallization necessarily requires a significant water uptake corresponding to an additional stage of change with relation to that described above. It also requires a sufficient concentration of crystallizable molecules, generally sucrose molecules, in the liquefied peripheral layer. When these two conditions are met, crystallization is observed, which extends from the surface of the candy to its center. This phenomenon, when uncontrolled, is known as turning. It makes the candies completely opaque and white.

[0014] Crystallization can also occur very directly in the core of the hard candy if the latter is very rich in water or if the storage temperature is too high. Under these conditions, the hard candy then is excessively soft and cannot be considered a true solid. This is a liquid supersaturated in crystallizable molecules, which inevitably develops toward a crystalline state almost spontaneously. Specialists call this type of crystallization graining.

[0015] Definitely, in order for hard candies not to become unstable or sticky over time or to become turned or grained products, it has always seemed necessary to adjust part of their water content and also their crystallizable molecule content, ie, generally their sucrose content.

[0016] Following manufacture, the hard candies obtained are either individually wrapped before being bagged or are packaged directly in bags or cardboard boxes without individual wrappers. In the latter case, the hard candies are said to be naked, ie, without individual wrappers.

[0017] There are currently four solutions for making hard candies sufficiently stable to humidity and heat to be sold unwrapped.

[0018] The first solution is to make candies based on hydrogenated starch hydrolyzate and isomalt syrup. To be sold without individual wrappers, the hard candies must contain over 80% isomalt by weight as against dry matter. These candies have been described by Leatherhead Food R.A. in its report No. 652, page 11, June 1989 (authors: G.A. Hammond and J.B. Hudson). The combination of these two products, while limiting the water uptake of the candies obtained thanks to the slightly hygroscopic nature of isomalt, caused a major increase in the resale price of the candy and a very appreciable loss of sweetening power. Indeed, isomalt is difficult to handle and therefore poorly suited as a bulking agent for products made in large quantities. Further, this carbohydrate contains 5% water of crystallization and therefore requires elevated cooking temperatures to provide for sufficient dehydration of the syrup to obtain a quality hard candy. Finally, isomalt-based hard candies tend to grain over time.

[0019] The second solution is to make the candies on a sorbitol basis. This polyol provides hard candies that remain stable to moisture thanks to the microcrystallization of the polyol in the bulk and on the surface. This microcrystallization is not visible to the unaided eye and the hard candy is translucent immediately after manufacture. However, it gradually tends to whiten on the surface, diminishing its attractiveness.

[0020] The third solution is to frost the hard candy. Frosting consists of applying a crystallizable syrup, usually sucrose, to the surface of the hard candy. The crystallization of the sucrose on the hard candy surface creates a barrier to moisture exchanges. However, frosting precludes translucence of the frosted hard candy.

[0021] The third solution is to make hard candies with a very high sucrose content (over 70% by weight as against dry matter). However, the chief defect of these candies is that they whiten very quickly on the surface. They then become opaque.

[0022] One alternative would be to provide a particular carbohydrate composition that would provide a sugarless hard candy that is stable to moisture and heat and does not tend gradually to become opaque and white on the surface or in the bulk. Several compositions have been proposed for this. For example, the document WO-A-95/26645 describes a sweetening composition comprising essentially lactitol, polydextrose and an intense sweetener. When such a composition is used to manufacture sugarless hard candies, these candies are not stable without individual wrappings. This composition is thus unsuitable for manufacturing unwrapped hard candies.

[0023] The document US-A-5,236,719 describes a dextrin whose low molecular compounds have been eliminated by chromatography. It is sold under the trade name FIBERSOL G, and is used in combination with xylitol, sorbitol or maltitol in the manufacture of hard candies. However, because the polyols combined with the dextrin are very soluble, they do not crystallize on the surface of the hard candy. Indeed, as soon as the hard candies with this composition come into contact with the atmosphere, they tend to take up water and become sticky. Consequently, the hard candies obtained with such a composition must necessarily be individually wrapped to limit this water uptake.

[0024] The purpose of this invention is to remedy the drawbacks of the prior art and propose a new sweetening composition, ie, a composition for hard candies or for use as a flavor vehicle, which responds appreciably better than existing compositions to the expectations of confectioners and to the different requirements of the field, ie, having appreciably improved storage stability.

[0025] As a result of intensive research, the applicant company had the merit of finding that this goal could be achieved and, quite unexpectedly, a stable unwrapped hard candy could be prepared using an inventive amorphous sweetening composition.

[0026] The hard candy thus obtained can be considered stable if it does not have a tendency, in the unwrapped state, to gradually:

– become sticky,
– grain or turn opaque and white on the surface and in the bulk,
– deform at the usual summer temperatures in temperate climates.

[0027] The applicant company discovered that, surprisingly and unexpectedly, to obtain a stable hard candy, it is suitable to use for its manufacture a composition comprising a sparingly soluble compound chosen from among sugars and polyols and at least one anticrystallizing agent for said compound.

[0028] Thus, the object of the invention is a sweetening composition characterized by the fact that it comprises:

(a) at least one sparingly soluble compound having a water solubility of less than 60 g/100 g of solution at 20• C, chosen from group consisting of sugars and polyols, alone or in mixtures of these; and

(b) at least one anticrystallizing agent comprising a fraction of at least one oligosaccharide or polysaccharide chosen from the group consisting of starch hydrolyzates with a molecular weight in the range of 500-8,000 Daltons and having a glass transition temperature (Tg) of less than 140• C, said Tg being measured at a water content of 0%, and pyrodextrins and polyglucoses of molecular weights ranging from 1,000 to 8,000 Daltons, alone or in mixtures thereof.

[0029] Without being bound by any theory, the applicant company believes, after intensive research, that the remarkable stability of the inventive composition can be explained as follows. The sparingly soluble compound of the inventive composition, ie, the sugar or polyol, rapidly crystallizes on the surface of the

hard candy, thereby restricting transfers of water from the atmosphere to the hard candy. Thanks to this microcrystallized surface layer, the hard candy is stabilized toward moisture. The anticrystallizing agent provides both stability toward the atmosphere and the characteristic of translucence. Selected with precision with regard to its molecular weight, it enables the glass transition temperature of the inventive composition to be adjusted beyond ambient temperature, and particularly, to a glass transition temperature in excess of 30• C at its actual water content. With such a glass transition temperature, the hard candies obtained using the inventive composition do not deform. Thus, by combining a sparingly soluble compound with an anticrystallizing agent for this same compound in the inventive composition, it is possible to prepare stable unwrapped hard candies.

[0030] In the present invention, the term "fraction of at least one oligosaccharide or polysaccharide" refers to the selection of such a compound having a specific molecular weight or a specific molecular weight range.

[0031] The oligosaccharide and/or polysaccharide can be chosen from among starch hydrolyzates having a molecular weight in the range of 500-8,000 Daltons. As defined in the present invention, the term "starch hydrolyzate" refers to any product or mixture of products produced by hydrolysis of a starch of any kind by chemical or enzymatic means, provided these products meet the dual condition of having a molecular weight in the range of 500-8,000 Daltons and a glass transition temperature (Tg) of 140• C or less, said Tg being measured at a water content of 0%, which excludes, for example, maltodextrins.

[0032] This fraction can also be chosen from among pyrodextrins or polyglucoses having a molecular weight in the range of 1,000-8,000 Daltons (which excludes, for example, the polydextrose sold by the Pfizer company). Advantageously, the pyrodextrins or polyglucoses used in the invention have a molecular weight ranging from 1,000 to 6,000, preferably from 2,000 to 5,000, and more specifically, from 4,000 to 5,000 Daltons.

[0033] As defined in the present invention, the term polyglucose refers to products consisting primarily of 1,6 linkages obtained by condensation or rearrangement from glucose under the combined action of heat and acids in a medium almost completely free of water, provided they meet the condition of having a molecular weight within the ranges mentioned above.

[0034] In the present invention, the term pyrodextrins refers to products obtained by heating starch with a low moisture content in the presence of generally acid or basic catalysts, provided they satisfy the condition of having a molecular weight in the ranges mentioned above. This dry roasting of starch, generally in the presence of acid, causes both depolymerization of the starch and rearrangement of the starch fragments obtained, resulting in highly branched molecules.

[0035] The fractions of starch hydrolyzates, pyrodextrins or polyglucoses can be used singly or in mixtures thereof in the inventive composition.

[0036] Advantageously, the anticrystallizing agent is hydrogenated and/or oxidized. Excellent results were thus obtained using maltotriitol as the hydrogenated starch hydrolyzate fraction, or with a dextrin having a molecular weight of ca 4,500 Daltons as the hydrogenated pyrodextrin fraction, in combination with a sparingly soluble compound chosen from the group consisting of trehalose, lactose, mannose, maltose, erythritol, mannitol, glucopyranosido-1,6-mannitol and lactitol.

[0037] In a particular embodiment of the invention, the weight ratio of anticrystallizing agent to sparingly soluble compound is in the range of 10/90 - 90/10, preferably 20/80 - 80/20.

[0038] Thus, excellent results were obtained using inventive compositions comprising:

- 25-35 wt% mannitol, as against dry matter, and 65-75 wt% of a hydrogenated dextrin fraction, as against dry matter,
- 65-75 wt% lactitol as against dry matter and 25-35 wt% hydrogenated dextrin fraction as against dry matter,
- 40-80 wt% glucopyranosido-1,6-mannitol as against dry matter and 20-60 wt% maltotriitol as against dry matter.

[0039] Other characteristics and advantages of the invention will be evident from the following examples relating to the use of the inventive composition in the manufacture of hard candies. These examples are given by way of illustration and are non-limiting.

Example 1: Impact of the Nature of the Sparingly Soluble Compound

[0040] In this example, the anticrystallizing agent used is a hydrogenated dextrin with a molecular weight of 4,500 Daltons. It is used in combination with different polyols in the proportions indicated in Table 1.

Table 1

Test	Polyol	% Polyol	% Anticrystallizing Agent
1	mannitol	30	70
2	lactitol	70	30
3	maltitol	50	50
4	isomalt (control)	100	0

[0041] Tests 1 and 2 are of the present invention. Test 3 is a comparative test using a polyol that is not part of the present invention. Test 4 is the control test using 100% isomalt (equimolecular mixture of glucosido-1,6-mannitol and isomaltitol obtained by hydrogenation of isomaltulose produced by enzymatic conversion of sucrose).

[0042] Carbohydrate solutions with 75% dry matter were made from the compositions shown in Table 1 by dissolution in an appropriate amount of water.

[0043] The syrups obtained were cooked over an open flame at a selected temperature ranging from 140 to 180• C.

[0044] The hard candies thus prepared were analyzed for their water content and glass transition temperature. Further, stability tests were conducted by placing the hard candy without individual wrappings in a microclimate at 66% relative humidity and 20• C for 10 days. At the end of this period, the hard candies were observed for deformation, stickiness and state of crystallization (graining). The rating scale is as follows:

0: none
+: traces
++: major
+++: very major

[0045] The results of the stability tests obtained for hard candies manufactured from the compositions described in Table 1 are shown in Table 2.

Table 2

Test	Cooking Temperature (•C)	Initial Water (%)	Tg (•C)	Deformation	Stickiness	Graining
1	140	3.0	35.3	0	0	++
2	150	3.3	41.5	0	0	++
3	150	2.4	49.2	+	++	0/+
4	180	2.0	49.0	0	0	+++

[0046] The hard candies prepared from the inventive compositions, particularly that containing 70% hydrogenated dextrins and 30% mannitol, with 3.0% residual moisture, and that comprising 30% hydrogenated dextrins and 70% lactitol, with 3.3% moisture, have a stability comparable to that of the hard candies prepared from 100% isomalt. The hard candies are never sticky and do not deform. They can therefore be sold unwrapped.

[0047] These same hard candies grain less rapidly than the isomalt-based hard candies.

Example 2: Impact of the Molecular Weight of the Anticrystallizing Agent

[0048] Several hard candies are prepared by cooking the following mixtures, all of which have an initial dry matter of about 75%:

- a first mixture comprising 70% lactitol and 30% hydrogenated polydextrose with a molecular weight of 800 Daltons, as against dry matter (product sold by the Pfizer company),
- a second inventive mixture comprising 70% lactitol and 30% hydrogenated dextrin with a molecular weight of 4,500 Daltons, as against dry matter.

[0049] These two mixtures were cooked over an open flame at a temperature of 155•C so as to obtain hard candies containing 3.5% residual water.

[0050] The hard candies thus prepared were analyzed for their water content and glass transition temperature. Further, stability tests were conducted by placing the hard candies without individual wrappers in a microclimate with 66% relative humidity and a temperature of 20•C for 10 days. Following this period, the hard candies were observed for deformation, stickiness and state of crystallization (graining). The rating scale was as follows:

0: none
+: traces
++: major
+++: very major

[0051] The results of the stability test are shown in Table 3.

Table 3

	Moisture Content	Tg (• C)	Deformation	Stickiness	Graining
Mixture 1	3.6	49.4	+	+	+++
Mixture 2	3.0	45	0	0	++

[0052] The hard candies prepared from the second inventive mixture are never sticky and do not deform. Thus, they can be sold unwrapped.

[0053] These same hard candies grain less quickly than lactitol-based and polydextrose-based hard candies.

Example 3:

[0054] Several hard candies are prepared by cooking the following mixtures, all of which have an initial dry matter of about 75%:

- a first inventive mixture composed of 30% maltotriitol and 70% glucopyranosido-1,6-mannitol (GPM), as against dry matter,
- a second inventive mixture composed of 50% maltotriitol and 50% GPM, as against dry matter,
- a third mixture (control) composed of 100% isomalt as against dry matter.

[0055] These three mixtures were cooked over an open flame at a temperature of 180• C to obtain hard candies.

[0056] The hard candies thus prepared were analyzed for their moisture content and glass transition temperature. Further, stability tests were conducted by placing the hard candies in individual packages in a microclimate with 66% relative humidity and 20• C for 10 days. Following this period, the hard candies were observed for deformation, stickiness and state of crystallization (graining). They rating scale was as follows:

0: none
+: traces
++: major
+++: very major

[0057] The results of the stability tests are shown in Table 4.

Table 4

	Moisture Content	Tg (• C)	Deformation	Stickiness	Graining
Mixture 1	2.1	53.8	0	0	+
Mixture 2	2.3	52.9	0	0	++
Mixture 3	2.0	49.0	0	0	+++

[0058] The hard candies prepared from an inventive composition comprising 30-50% maltotriitol and 70-50% glucopyranosido-1,6-mannitol, as against dry matter, have an appearance similar to that of isomalt-based hard candies: no sticking and no deformation.

Claims

1. A sweetening composition characterized in that it comprises:

   a) at least one sparingly soluble compound with a water solubility of less than 60 g per 100 g of solution at 20• C, chosen from the group consisting of sugars and polyols, individually or as a mixture thereof; and
   b) at least one anti-crystallizing agent comprising a fraction of at least one oligosaccharide or polysaccharide chosen from the group consisting of starch hydrolyzates with a molecular weight in the range of 500 to 8,000 Daltons and having a glass transition temperature of less than 140• C at a water content of 0% and pyrodextrins and polyglucoses with a molecular weight in the range of 1,000 to 8,000 Daltons, individual or as a mixture thereof.

2. A composition according to Claim 1, characterized in that the pyrodextrins or polyglucoses have a molecular weight in the range of 1,000 to 6,000, preferably in the range of 2,000 to 5,000, and particularly in the range of 4,000 to 5,000 Daltons.

3. A composition according to Claim 1 or 2, characterized in that the anti-crystallizing agent is hydrogenated and/or oxidized.

4. A composition according to any of Claims 1 through 3, characterized in that the sparingly soluble compound is chosen from the group consisting of trehalose, lactose, mannose, maltose, erythritol, mannitol, glucopyranosido-1,6-mannitol and lactitol.

5. A composition according to any one of Claims 1 through 4, characterized in that the ratio by weight of anti-crystallizing agent to sparingly soluble compound is between 10/90 and 90/10, preferably between 20/80 and 80/20.

6. A composition according to any one of Claims 1 through 5, characterized in that it comprises 25-35 wt% mannitol and 65-75 wt% of a fraction of hydrogenated dextrins, as against dry matter.

7. A composition according to any one of Claims 1 through 5, characterized in that it comprises 65-75 wt% lactitol and 25-35 wt% of a fraction of hydrogenated dextrins, as against dry matter.

8. A composition according to any one of Claims 1 through 5, characterized in that it comprises 40-80 wt% glucopyranosido-1,6-mannitol and 20-60 wt% maltotriitol, as against dry matter.

9. Use of a composition according to any one of Claims 1 through 8 for the manufacture of a hard candy.

10. Use of a composition according to any one of Claims 1 through 8 as a flavoring carrier.